

Invited talk by Madeleine Gibescu, Eindhoven University of Technology, The Netherlands

Machine learning methods for on-line prediction and optimal resource allocation in smart buildings and grids

ABSTRACT

This talk will present some results from the TKI SG-BEMS project, based on the work of PhD researchers Elena Mocanu and Luis Hurtado-Munoz, together with my colleague and project leader Dr. H.P. Nguyen. The work focuses on the possibilities for exploiting demand flexibility from an aggregation of buildings in a smart grid context. Both residential and office buildings may be able to scale or time-shift part of their demand in order to decrease energy costs, reduce peaks and/or aid the distribution grid operator in performing congestion management. In order to achieve mutual benefits for both the building manager and the grid operator, both energy demand prediction and optimal scheduling of energy resources are necessary.

We will first present some results on machine learning methods for solving the problem of aggregated energy demand prediction [1]. Secondly, we describe how a multi-agent system can coordinate the actions of a number of buildings in responding to flexibility requests from the grid operator while maintaining the comfort level of the users. Non-cooperative (N-player game, Q-learning) versus cooperative (eJAL - extended joint action learning) strategies are compared in terms of fairness, comfort loss, and ability to reduce the grid overload [2-3].

[1] E. Mocanu, E.M. Larsen, P.H. Nguyen, P. Pinson and M. Gibescu, Demand forecasting at low aggregation levels using factored conditional restricted Boltzmann machine. Proceedings of the 19th Power Systems Computation Conference (PSCC), Genova, Italy, 2016.

[2] L.A. Hurtado-Munoz, P.H. Nguyen, M. Gibescu and I.G. Kamphuis, Multi-agent systems for demand flexibility management in the built environment. Invited panel presentation, IEEE PES General Meeting, Boston, USA, 2016.

[3] L.A. Hurtado-Munoz, "Uncovering Demand Flexibility in Buildings -- A smart grid inter-operation framework for the optimisation of energy and comfort", Ph.D. Thesis, Eindhoven University of Technology, March 2017.

Madeleine Gibescu received her Dipl.Eng. in Power Engineering from the University Politehnica, Bucharest, Romania in 1993 and her MSEE and Ph.D. degrees from the University of Washington, Seattle, WA, U.S. in 1995 and 2003, respectively. She has worked as a Research Engineer for ClearSight Systems, and as a Power Systems Engineer for the Alstom Grid, Washington, U.S. From 2007, she has worked as an Assistant Professor for the Electrical Sustainable Energy Department, Delft University of Technology, the Netherlands. Currently she is an Associate Professor with the Electrical Energy Systems Department, Eindhoven University of Technology, the Netherlands. Her research

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